

Amendment to Claims

This listing of Claims will replace all prior versions and listings of claims in this Application.

Listing of Claims

Claim 1. (WITHDRAWN) A method of adhering copper thin film to a substrate in an integrated circuit structure comprising:

preparing a substrate, including forming active regions, vias and trenches for interconnect structures;

depositing a metal barrier layer on the substrate;

depositing an ultra thin film layer of tungsten over the barrier metal layer;

depositing a copper thin film on the tungsten ultra thin film layer;

removing excess copper and tungsten to the level of the metal barrier layer; and

completing the integrated circuit structure.

Claim 2. (WITHDRAWN) The method of claim 1 wherein said depositing an ultra thin film layer of tungsten includes depositing a tungsten layer having a thickness of between about 1 nm to 5 nm.

Claim 3. (WITHDRAWN) The method of claim 1 wherein said depositing an ultra thin film layer of tungsten includes depositing the tungsten by a deposition method taken from the group of methods consisting of MOCVD and ALD.

Claim 4. (WITHDRAWN) The method of claim 1 wherein said depositing an ultra thin film layer of tungsten includes depositing the tungsten from a precursor taken from the group of precursors consisting of WF_6 and $\text{W}(\text{CO})_6$.

Claim 5. (WITHDRAWN) The method of claim 1 wherein said depositing a barrier metal layer includes depositing a layer of material taken from the group of materials consisting of Ta, TiN, TaN and TiSiN.

Claim 6. (WITHDRAWN) The method of claim 1 wherein said depositing a barrier metal layer includes depositing a layer of material to a thickness of between about 5 nm to 10 nm.

Claim 7. (WITHDRAWN) The method of claim 1 wherein said depositing a barrier metal layer includes depositing a layer of material by PVD, ALD or MOCVD.

Claim 8. (WITHDRAWN) The method of claim 1 wherein said depositing a copper thin film includes depositing a layer of copper to a thickness sufficient to fill vias and trenches in the structure.

Claim 9. (WITHDRAWN) The method of claim 8 wherein said depositing a copper thin film includes depositing a layer of copper to a thickness sufficient to fill vias and trenches in the structure includes depositing a layer of copper to a thickness of between about 10 nm to 20

nm.

Claim 10. (WITHDRAWN) The method of claim 1 wherein said depositing a copper thin film includes depositing a layer of copper by PVD, ALD or MOCVD.

Claim 11. (WITHDRAWN) A method of adhering copper thin film to a substrate in an integrated circuit structure comprising:

preparing a substrate, including forming active regions, vias and trenches for interconnect structures;

depositing a metal barrier layer on the substrate;

depositing an ultra thin film layer of tungsten over the barrier metal layer to a thickness of between about 1 nm to 5 nm from a precursor taken from the group of precursors consisting of WF_6 and $\text{W}(\text{CO})_6$;

depositing a copper thin film on the tungsten ultra thin film layer;

removing excess copper and tungsten to the level of the metal barrier layer; and completing the integrated circuit structure.

Claim 12. (WITHDRAWN) The method of claim 11 wherein said depositing an ultra thin film layer of tungsten includes depositing the tungsten by a deposition method taken from the group of methods consisting of MOCVD and ALD.

Claim 13. (WITHDRAWN) The method of claim 11 wherein said depositing a barrier metal layer includes depositing a layer of material taken from the group of materials consisting of Ta, TiN, TaN TaSiN and TiSiN.

Claim 14. (WITHDRAWN) The method of claim 11 wherein said depositing a barrier metal layer includes depositing a layer of material to a thickness of between about 5 nm to 10 nm.

Claim 15. (WITHDRAWN) The method of claim 11 wherein said depositing a barrier metal layer includes depositing a layer of material by PVD, ALD or MOCVD.

Claim 16. (WITHDRAWN) The method of claim 11 wherein said depositing a copper thin film includes depositing a layer of copper to a thickness sufficient to fill vias and trenches in the structure.

Claim 17. (WITHDRAWN) The method of claim 16 wherein said depositing a copper thin film includes depositing a layer of copper to a thickness sufficient to fill vias and trenches in the structure includes depositing a layer of copper to a thickness of between about 10 nm to 20 nm.

Claim 18. (WITHDRAWN) The method of claim 11 wherein said depositing a copper thin film includes depositing a layer of copper by PVD, ALD or MOCVD.

Claim 19. (CURRENTLY AMENDED) An integrated circuit having a copper interconnect therein formed over a layer of barrier metal comprising:

 a substrate, including active regions, vias and trenches for interconnect structures;
 a metal barrier layer formed on the substrate, wherein said metal barrier layer is taken from the group of materials consisting of Ta, TiN, TaN and TiSiN, and formed to a thickness of between about 5 nm to 10 nm;
 an ultra thin film layer of tungsten formed on the barrier metal layer, said tungsten ultra thin film layer having a thickness of between about 1 nm to 5 nm; and
 a copper thin film layer formed on the tungsten ultra thin film layer to a thickness to sufficient to fill the vias and trenches in the structure.

Claim 20. (ORIGINAL) The integrated circuit of claim 19 wherein said ultra thin film layer of tungsten is formed from a precursor taken from the group of precursors consisting of WF₆ and W(CO)₆.

Claim 21. (CURRENTLY AMENDED) The method integrated circuit of claim 19 wherein said depositing a copper thin film includes depositing a layer of copper to a thickness sufficient to fill the vias and trenches in the structure includes depositing a layer of copper to a thickness of between about 10 nm to 20 nm.

Claim 22. (NEW) The integrated circuit of claim 19 wherein said metal barrier layer is

formed to a thickness of between about 5 nm to 10 nm.

Claim 23 (NEW) An integrated circuit having a copper interconnect therein formed over a layer of barrier metal comprising:

a substrate, including active regions, vias and trenches for interconnect structures;

a metal barrier layer formed on the substrate, wherein said metal barrier layer is

taken from the group of materials consisting of Ta, TiN, TaN and TiSiN;

an ultra thin film layer of tungsten formed on the barrier metal layer, said tungsten ultra thin film layer having a thickness of between about 1 nm to 5 nm; and

a copper thin film layer formed directly on the tungsten ultra thin film layer to a thickness to sufficient to fill the vias and trenches in the structure.

Claim 24. (NEW) The integrated circuit of claim 23 wherein said ultra thin film layer of tungsten is formed from a precursor taken from the group of precursors consisting of WF₆ and W(CO)₆.

Claim 25. (NEW) The integrated circuit of claim 23 wherein said depositing a copper thin film includes depositing a layer of copper to a thickness sufficient to fill the vias and trenches in the structure includes depositing a layer of copper to a thickness of between about 10 nm to 20 nm.

Claim 26. (NEW) The integrated circuit of claim 13 wherein said metal barrier layer is formed to a thickness of between about 5 nm to 10 nm.

Claim 27. (NEW) An integrated circuit having a copper interconnect therein formed over a layer of barrier metal comprising:

 a substrate, including active regions, vias and trenches for interconnect structures;

 a metal barrier layer formed on the substrate, wherein said metal barrier layer is taken from the group of materials consisting of Ta, TiN, TaN and TiSiN, and formed to a thickness of between about 5 nm to 10 nm;

 an ultra thin film layer of tungsten formed on the barrier metal layer, said tungsten ultra thin film layer having a thickness of between about 1 nm to 5 nm; and

 a copper thin film layer formed on the tungsten ultra thin film layer to a thickness to sufficient to fill the vias and trenches in the structure, including depositing a layer of copper to a thickness of between about 10 nm to 20 nm.

Claim 28. (NEW) The integrated circuit of claim 17 wherein said ultra thin film layer of tungsten is formed from a precursor taken from the group of precursors consisting of WF_6 and $\text{W}(\text{CO})_6$.